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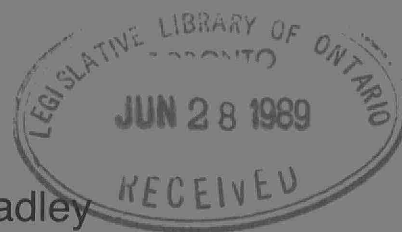
PHYTOTOXICOLOGY ASSESSMENT SURVEY
INVESTIGATION OF DECLINE OF
WILLOW TREES IN THE VICINITY OF
DOMTAR'S WOOD PRESERVATIVE PLANT
AND STORAGE YARD
MARMORA STREET, TRENTON
SEPTEMBER 18, 1987

OCTOBER 1988



Environment
Ontario

Jim Bradley
Minister



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Phytotoxicology Assessment Survey Investigation
of Decline of Willow Trees in the Vicinity of
Domtar's Wood Preservative Plant and Storage Yard
Marmora Street, Trenton
September 18, 1987

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OCTOBER 1988

En septembre 1987, des dépôts d'une substance ressemblant à de la créosote ont été découverts le long du rivage est de la Trent, à proximité de l'usine de produits de préservation du bois de la société Domtar, usine désignée ci-après sous l'appellation de Domtar. Domtar a avisé le personnel du ministère de l'Environnement à Kingston de la situation, et le Ministère a commencé une enquête. De plus, un représentant des médias locaux a informé le Ministère que les vieux saules pleureurs sur la rive est de la rivière, près de la limite ouest de Domtar, étaient bruns. À cet égard, M. J. Pruner, du bureau régional du Sud-Est du Ministère, a demandé qu'une enquête soit menée par la Section de phytotoxicologie pour déterminer la cause de la détérioration des arbres. MM. Emerson et McLaughlin ont, le 18 septembre 1987, conduit l'enquête phytotoxicologique pour cette section.

En résumé, les conclusions de l'enquête ont montré que les vieux saules pleureurs malades le long de la rive, près de la limite ouest de Domtar, présentaient des concentrations élevées d'un herbicide hautement phytotoxique, le tébuthiuron. Ainsi, les effets observés sur les arbres en 1987 étaient liés à l'application, l'année précédente, de tébuthiuron sur la propriété de Domtar. L'enquête n'a pas établi que les dépôts noirâtres trouvés le long de la rive en 1987 étaient la cause

première, car la zone des arbres endommagés s'étendait bien au-delà du rivage où les rochers et le sol avaient été tachés par cette substance ressemblant à de la créosote.

Il faudrait faire remarquer que le Ministère étudie actuellement le tébuthiuron et qu'une enquête a été effectuée sur plusieurs autres cas de dégâts causés involontairement à la végétation en dehors de la zone d'application du tébuthiuron.

Phytotoxicology Assessment Survey Investigation of Decline of Willow
Trees in the Vicinity of Domtar's Wood Preservative Plant
and Storage Yard, Marmora Street, Trenton

September 18, 1987

Background

In September 1987, deposits of a creosote-like material were discovered along the Trent River's east shoreline in the vicinity of the Domtar wood preservative property, hereafter referred to as Domtar. Domtar notified MOE staff in Kingston and MOE investigations followed. In addition, a local media representative informed the MOE that the mature weeping willow trees along the river's east bank next to Domtar's west boundary were brown. In this regard, Mr. J. Pruner, MOE Southeast Region, requested that an investigation be conducted by the Phytotoxicology Section to determine the cause of the tree decline. The Phytotoxicology investigation was conducted by Messrs Emerson and McLaughlin on September 18, 1987.

Prior to the investigation, the writer obtained permission to be on the Domtar property from Mr. M. Xanthos, Manager of the Wood Preservative Operations. Mr. Xantos reported that in 1986, Domtar employed the Weed Man of Trenton to eradicate vegetation growth on the property and that the herbicide used had been applied at or near the property boundaries. Subsequent to the investigation, the writer learned from Mr. D. Raddon (Pesticide Officer, MOE, Kingston) that the herbicide tebuthiuron was applied to the Domtar property in 1986 (but not in 1987). Tebuthiuron is applied to soil and is a highly phytotoxic residual herbicide used for long-term vegetation control.

Field Investigation

On September 18, 1987, Messrs Emerson and McLaughlin examined the weeping willow trees neighbouring Domtar's west boundary as well as willow trees more remote from Domtar. Other trees and ground cover vegetation which neighboured the affected willows were examined as were

trees and other vegetation in the vicinity of Domtar's north and east boundaries. The investigators also examined the east riverbank along Domtar's west boundary for any unusual blackish deposition. Several photographs were taken. Finally, several samples of willow foliage, twigs and soil were collected for chemical analysis.

Observations

The blackish, creosote-like deposition found along the river's east shoreline was initially discovered in the general area of collection Site 1 (see map attached).

In this area, a containment boom had been placed in the river and an interceptor ditch had been dug by Domtar near the west limit. The interceptor ditch was partly filled with water and the water in both the river containment area and the interceptor ditch exhibited a bluish surface film. Moreover, the exposed subsoil in the ditch had a blackish stain.

A blackish stain also was observed on several rocks along the river-shore in the area of Site 1, and inspections to the north revealed similar staining on rocks here and there along the shoreline through to the area of Site 2, but not beyond this area. In some areas, a blackish, creosote-like material was seeping from fissures in the bedrock.

During inspections of the shoreline, several stained rocks were overturned and the soil underneath was found to be blackish and have a creosote-like odour. Overturning of stained rocks abutting the river-edge resulted in a bluish surface film on the water in the river.

The preceding observations would indicate that the blackish, creosote-like material observed along the river's east shore had originated from the Domtar property.

During the investigation, the mature willow trees in the vicinity of Domtar's west boundary were inspected. These trees were rooted in the riverbank just west of the security fence along Domtar's west boundary. Inspections revealed that most willow trees adjacent to Domtar had injured (brown) foliage throughout the crown, an indication that the affected trees were declining. An exception was the willow tree sampled at Site 1. This tree exhibited a full crown of greenish foliage, with foliar examinations revealing no unusual injury. The injured willow trees were situated to the north of Site 1 through to Site 4 (northwest corner of Domtar property). In the vicinity of the affected willows, other tree species (Manitoba and silver maples, ash, sumac, etc.) also were declining or dead, with most smaller trees abutting Domtar's west boundary fence near Sites 2, 3 and 4 being entirely defoliated. Inspections over the larger area revealed that the tree injury was confined to the vicinity of Domtar.

The observations near Sites 3 and 4 (Domtar property northwest corner) also revealed distinct, mostly barren soil areas, where ground cover vegetation (grasses/weeds) had been killed, extending from Domtar's west boundary through to the river, indicating that a phytotoxic material had moved into these site areas. At Site 4, the vegetation kill zone extended downgrade of a ditch which ran east to west adjacent to the north side of Domtar's north boundary fence. The northwest corner drained into the ditch which drained westward towards the river. In this area, the soil on the Domtar property and in the ditch, as in the vegetation kill zone on the riverbank, was primarily barren. The soil on the Domtar property along most of the west limit either was barren or had brown vegetation cover.

Several trees immediately north of Domtar's north boundary also were declining or dead. Near Marmora Street, several tree skeletons were adjacent to the north boundary, with the trees being rooted in or near the ditch just north of the boundary fence. The soil along the dry ditch was mostly barren and, on the Domtar property, along the north boundary, ground cover vegetation was either absent or brown. In the vicinity of Marmora Street, even a mature street tree just east of

the east boundary fence was dying. To the neighbouring west, a distinct zone of grass-kill was observed beside the east boundary fence (extent of grass-kill was not determined).

In light of the fact that the tree/vegetation injury zone extended well beyond the area where the creosote-like deposition was found, and that trees/vegetation affected were neighbouring property boundaries to which tebuthiuron had been applied in 1986, it was suspected that the tebuthiuron application was the primary cause of tree/vegetation injury observed in 1987. The presence of the herbicide-like vegetation kill pattern on the riverbank at Sites 3 and 4 would further support this belief.

Samples Collected for Analysis

Samples of foliage and current year's twigs were collected from three mature weeping willow trees (Sites 1, 2 and 3) next to Domtar's west boundary, as well as from a remote weeping willow (Site 5) to the north (see attached map). All sites were situated on the east bank of the Trent River. Willow Sites 2 and 3 were injured and the foliage collected at both sites was largely necrotic (brown or dead). In contrast, willow Sites 1 and 5 exhibited no unusual foliar injury, with the foliage sampled from these sites being a normal greenish-yellow colour.

In addition, surface soil (0-5 cm) was collected from the river-edge (shore) and/or from the bank, to the respective west (downgrade) and east (upgrade) of the willow tree sampled in each area. In addition, soil (0-5 cm) from the Domtar property west limit, which was further upgrade of the river-edge, was collected at Sites 2, 3 and 4. The soil collected at the river-edge at Sites 1 and 2 was blackish and exhibited a creosote-like odour. All other soil samples had a normal appearance and an earthy odour.

The sites were sampled in the same order they are numbered (e.g. Site 1 was sampled first) and the samples were sealed in separate glass jars following collection. Hygienic gloves were worn. Moreover, prior to sampling in each site, the sampling equipment was cleaned using the

cleaning protocol for organics analysis as a further precaution to avoid any cross contamination.

All samples were submitted for analysis to the Ontario Ministry of Agriculture and Food (OMAF) Agricultural Laboratory Services Pesticide Residue Section at the University of Guelph. The samples were analyzed for tebuthiuron, triazine herbicides (atrazine, simazine, etc.) and pentachlorophenol (PCP).

Analytical Results

The tebuthiuron results, presented in the attached table, show that the foliage, twig and soil samples collected at Sites 2, 3 and 4, (where mature willows and other vegetation were affected) had elevated tebuthiuron concentrations compared to control levels (Sites 1 and 5). The data show that there has been movement of this herbicide in the direction of the river suggesting that the tree injury was largely due to root uptake of tebuthiuron from the soil. The nature of this movement (surface versus sub-surface) could not be determined. The willow foliage (but not the twigs or soil) collected at Site 1 also contained tebuthiuron, suggesting that this herbicide was applied nearby in 1987. However, the Weed Man (A. Lyall) in Trenton reported to Mr. Raddon (Pesticides Officer, MOE, Kingston) that no tebuthiuron was applied by his firm to the Domtar wood preservative property during 1987.

The herbicide analysis data also revealed the presence of low atrazine levels in the soil collected on the Domtar property at Sites 2 (0.20 ppm) and 4 (0.02-0.12 ppm). However, the fact that no atrazine was detected in any of the twig and foliage samples indicates that atrazine was not the cause of the willow tree decline.

The foliage, twig and soil samples were additionally analyzed for pentachlorophenol (PCP), and PCP was detected in only the willow foliage samples collected next to Domtar's west boundary (Sites 1, 2, 3). PCP is applied to wood at Domtar, with the PCP wood treatment area being to the east of Site 1. As the foliar results displayed a pattern of decreasing PCP levels with distance to the north of Site 1, it is suspected that airborne emissions from the Domtar property were the

source of the PCP levels found in the foliage. However, the fact that the healthy willow foliage at Site 1 contained the highest PCP level (0.58 ppm) indicates that the PCP levels found in the injured willow foliage at Sites 2 and 3 (0.028 and 0.005 ppm, respectively) were not phytotoxic.

No PCP was detected in any of the soil samples which rules out the possibility that the blackish stain in the soil collected at the river-edge at Sites 1 and 2 was PCP. On the Domtar property, wood is also treated with creosote and oils (bunker C and furnace oil). Therefore, it is suspected that the blackish deposition observed along the shoreline was weathered creosote and/or oil.

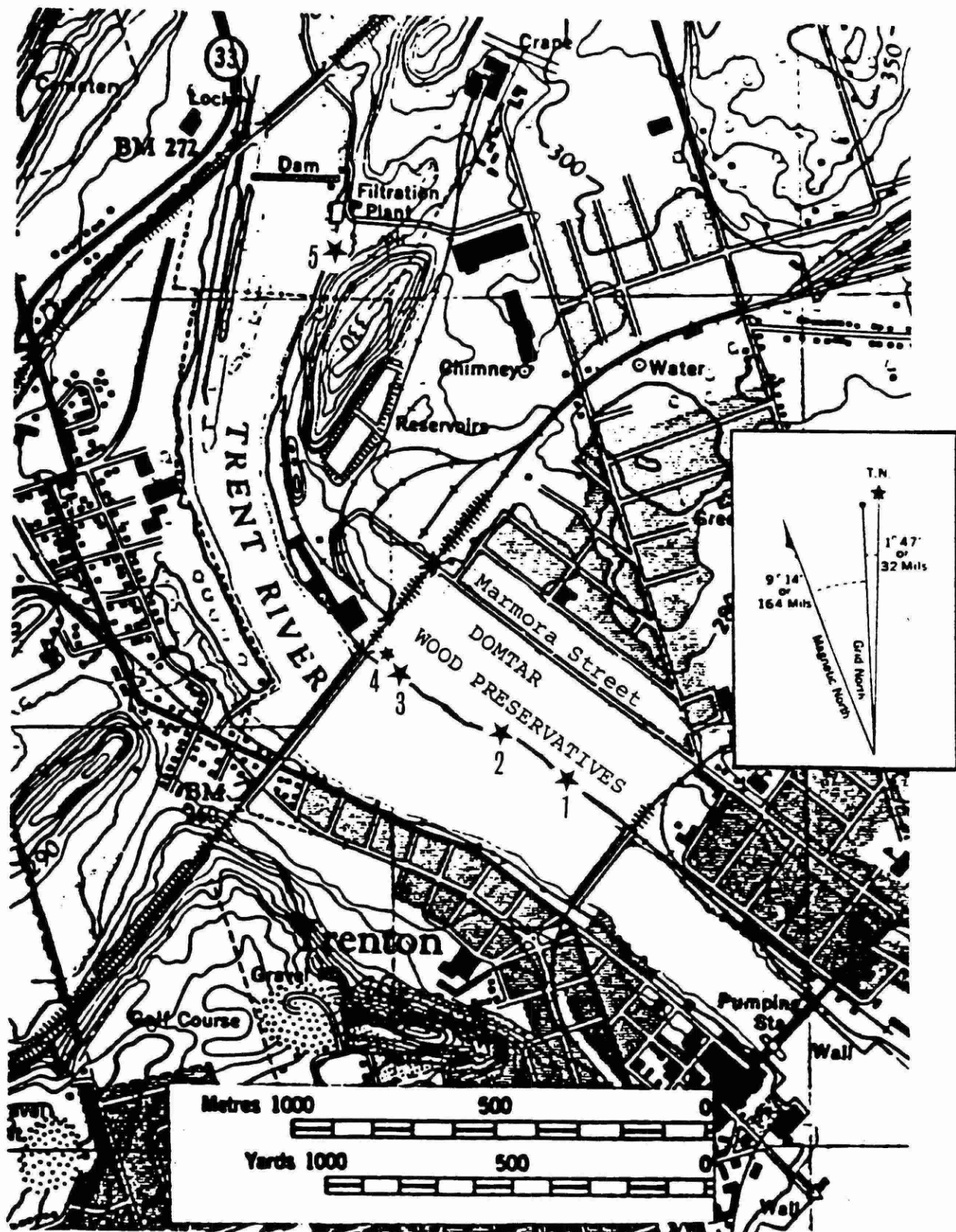
Summary

In summary, the investigation findings revealed that the mature weeping willow trees that were declining along the riverbank in the vicinity of Domtar's west boundary contained elevated levels of the highly phytotoxic herbicide tebuthiuron, indicating that the observed tree effects in 1987 were related to the previous year's tebuthiuron application to the Domtar property. The investigation did not suggest that the blackish deposition found along the shoreline in 1987 was the primary cause as the zone of tree injury extended well beyond the shoreline area where rocks and soil had been stained by the creosote-like material.

It should be noted that tebuthiuron is under review by the Ministry and that several other incidents involving off target tebuthiuron injury to vegetation have been investigated.

RE2191

Vegetation and Soil Collection Sites Relative to the
Domtar Wood Preservative Property, Trenton - Sept. 1987.



★ Vegetation and Soil Collection Area

★ Soil Collection Area

**Tebuthiuron Concentrations Detected in Foliage, Twig and
Soil Samples Collected in the Vicinity of and Remote from
Domtar's West Property Boundary - September, 1987.**

Site Area	Sampling Location	Tebuthiuron Concentration - ppm*		
		Foliage	Twigs	Soil (0-5 cm)
	<u>Willow Trees with Injured Foliage</u>			
2	Domtar W limit area	-	-	1.0
	Riverbank area	7.0	0.05	0.5
	Shore (rocky) area	-	-	NDa
3	Domtar W limit area	-	-	1.4b
	Riverbank area	6.7	0.31	0.75b
	Shore (soil) area	-	-	0.96b
4	Domtar W limit area	-	-	4.3b
	<u>Willow Trees with Healthy Foliage</u>			
1	Riverbank area	1.4	ND	ND
	Shore (rocky) area	-	-	NDa
5 ^c	Riverbank area	ND	ND	ND

* Concentration in sample as collected.

a Soil was blackish and had a creosote-like odour.

b Soil collection area was primarily barren.

c Remote control site.

ND Tebuthiuron was not detected.

RE2191



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